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Preliminary Regional Magnitude Results in the Middle East Region Using Narrowband L_g Coda Envelopes

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Because many regional seismic discriminants are functions of magnitude, it is important to obtain a stable measurement especially for smaller events that will likely have very limited station coverage. We have collected and analyzed regional broadband waveforms from stations in the middle east region for the purpose of calibrating a stable regional magnitude scale that can be applied to events that are too small to detect teleseismically. Our approach is to obtain frequency-dependent empirical Green's function coda envelopes for narrow frequency bands that can be used to correct for gross path effects. To avoid regional biases we tie our coda envelope amplitude measurements to seismic moments obtained from long period 1-D waveform modeling for moderate sized earthquakes (M_W~3.5.-4.5). We make the assumption that the moment-rate spectra are generally flat below -2 Hz for these events. In a least squares sense, we obtain frequency-dependent corrections to the L_g coda measurements to fit the scalar moment estimates. These frequency-dependent corrections remove the effects of the S-to-L_g coda transfer function, thus correcting back to the S-wave source spectra. Due to the averaging nature of L_g coda waves we are then able to obtain a stable single station estimate of the source spectra. Most importantly, we can now apply the same corrections to significantly smaller events that cannot be observed teleseismically.

Our empirical approach takes into account scattering, absorption, and waveguide losses as well as frequency-dependent site effects. Moreover, the use of the coda envelope mitigates the undesirable effects of source anisotropy, random site interference, path variability, and directivity that plague direct wave measurements. This approach has been successfully applied to other regions where it was observed that the coda-derived M_W estimates showed significantly smaller dependence on lateral variation in geology and source radiation anisotropy than the more conventional approaches such as $m_b(P_g)$, $m_b(L_g)$, and teleseismic m_b.

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